

In the specification at page 6, line 5, the first paragraph of the "Detailed Description of the Invention," please insert:

--The present invention provides a printed circuit board and a method for the production of a printed circuit board having fine-line circuitry and greater aspect ratio on a subcomposite with plated through holes. --

In the specification at page 11 line, 23, after "Additional circuitry" please delete [(not shown)] and insert: -- 60 --.

In the specification at page 11, line 28, after "circuit lines" please delete [(not shown)] and insert: -- 60 --.

REMARKS

Drawings:

The accompanying drawings have been corrected pursuant to the comments of the examiner in his letter of August 29, 2001 and in the examiner interview conducted with the undersigned on November 28, 2001.

Specifically, responsive to Item No. 1 of the examiner's letter of 08-29-01, Figures 1B and 2-10 have been amended to correct the element identified with reference character "16." This amendment is supported in the specification at page 6, lines 20-24, and is not believed to constitute new matter.

Responsive to Item No. 2 of the examiner's letter of 08-29-01, Figure 12 has been amended to illustrate exemplary circuitry disposed upon the layer of dielectric material as claimed in claims 18-20. (The specification is also amended consistent with this drawing amendment to refer to the circuitry as depicted in Figure 12 by reference character "60.") This amendment is supported in the specification at page 11, lines 15-30, and by claims 18-20, and is not believed to constitute new matter.

Upon indication of acceptability, formal drawings will be prepared incorporating the changes indicated.

Specification:

Item Nos. 3 and 4 of the examiner's letter object to the disclosure and abstract as "more oriented to the method of making the printed circuit board than to the instant claimed invention."

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Both the Abstract and the disclosure have been amended to more clearly identify the invention claimed by claims presently before the examiner.

Claim Rejections – 35 USC § 102:

Claims 11, 14, 17 and 20 are rejected under 35 USC § 102(b) as being anticipated by Boggs (U.S. Patent No. 4,935,584). Prior art is anticipatory only if every element of the claimed invention is disclosed in a single item of prior art in the form literally defined in the claim. Jamesbury Corp. v. Litton Indus. Products, 756 F.2d 1556, 225 USPQ 253 (Fed. Cir. 1985); Atlas Powder Co. v. du Pont, 750 F.2d 1569, 224 USPQ 409 (Fed. Cir. 1984); American Hospital Supply v. Travenol Labs, 745 F.2d 1, 223 USPQ 577 (Fed. Cir. 1984). Claim 11 claims a printed wiring board comprising a dielectric substrate, at least one filled plated through hole, and circuitry on said dielectric substrate connecting to said plated through hole, *said circuitry having an aspect ratio greater than about 1* (emphasis supplied). Boggs does not teach or disclose a printed wiring board comprising a dielectric substrate, at least one filled plated through hole, and circuitry on said dielectric substrate connecting to said plated through hole, said circuitry having an aspect ratio greater than about 1.

Specifically, Boggs does not teach circuitry having an aspect ratio greater than about 1. The examiner has cited Bogg's Figure 1 in asserting that said aspect ratio greater than about 1 is taught. However, as discussed with the examiner during the interview of 11/28/01, Bogg's does not provide a scale for his Figure 1. Unless otherwise affirmatively asserted by Boggs on Figure 1 or in the written specification, no scale may be properly imputed to Bogg's Figure 1. Moreover, Boggs does not indicate any element within his Figure 1 that teaches a fixed spacing between his circuitry, and nowhere within his specification teaches an aspect ratio greater than about 1. "Aspect ratio" is clearly defined in the specification at page 6, lines 10-11 as "the thickness of the circuit lines divided by the width of the spaces between the lines." A circuit line aspect ratio preferably greater than about 1 is clearly taught in the specification at page 10, lines 14-23.

Therefore, since every element of the claimed invention is not disclosed in Boggs in the form literally defined in claim 11, claim 11 is not properly rejected under 35 USC § 102(b) as being anticipated by Boggs, and is believed to be allowable as submitted.

Claims 14, 17 and 20 are dependent upon and include all of the limitations of claim 11, and are, therefore, for the above reasons, not properly rejected under 35 USC § 102(b) as being anticipated by Boggs, and are believed to be allowable as submitted.

Claim rejections – 35 USC § 103:

Claims 9, 10, 12, 13, 15 16 18 and 19 are rejected under 35 USC § 103(a) as being unpatentable over Boggs.

Claim 9 claims a printed wiring board comprising a dielectric substrate, at least one filled plated through hole, and circuitry on said dielectric substrate connecting to said plated through hole, *said circuitry having a line width approximately equal to or less than the diameter of said filled plated through hole*. (Emphasis supplied.) The examiner asserts the following:

It would have been obvious to one having ordinary skill in the art at the time the invention was made to [sic] said circuitry having a line width approximately equal to or less than the diameter of said filled plated through hole..., since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In *re Aller*, 105 USPQ 233.

In re Aller was decided in 1955 and subsequent case law disfavors its analysis and conclusions. The issue is whether the experimentation is within the teachings of the prior art. In re Waymouth et al. (CCPA 1974) 499 F2d 1273, 182 USPQ 290. Where the prior art gives no indication of which parameters are critical and no direction as to which of many possible choices is likely to be successful, the fact that the claimed combination falls within the scope of possible combinations taught therein does not render it unpatentably obvious. In re O'Farrell (CAFC 1988) 853 F2d 894, 7 USPQ2d 1673.

Boggs does not teach a specific circuit or method of producing circuitry and, therefore, inherently teaches a conventional prior art circuitry. The specification of the present application clearly establishes that conventional circuitry does not have a line width approximately equal to or less than the diameter of the filled plated through holes. Specifically, as provided at page 10, line 29, through page 11, line 14:

Additive plating also produces pads 44 with the diameter of the pads *now capable of being approximately equal to the diameter of the landless, plated through holes*. In conventional methods, using for example the subtractive etch method of circuitization, the plating process is completed before the through holes are filled with compound. Thus,

in conventional methods there is no layer of conductive metal plated over the filled through hole, which requires that a land of metal be made during the circuitization process to allow a solderable connection. The additive plating method of the present invention eliminates the need for lands on the subcomposite around the plated through holes. Thus, as an added benefit of the invention herein, a larger surface area is available for both increased component density and increased wiring density.

Therefore, under the law, as it is stated In re Aller, and in particular In re O'Farrell, it is clear that since Boggs gives no indication that his circuitry has a line width approximately equal to or less than the diameter of the filled plated through hole as claimed by claim 9, and no direction as to how to produce said line width under conventional means known to one skilled in the art, and no other prior art has been cited by the examiner to modify Boggs to teach the invention as claimed in claim 9, claim 9 is believed to be allowable over Boggs.

Claims 12, 15 and 18 are dependent upon and include all of the limitations of claim 9 and are, therefore, for the above reasons not properly rejected under 35 USC § 103 over Boggs, and are similarly believed to be allowable as submitted.

Claim 10 claims a printed wiring board comprising a dielectric substrate, at least one filled plated through hole, and circuitry on said dielectric substrate connecting to said plated through hole, *said circuitry having an aspect ratio greater than about 0.5.* (Emphasis supplied.)

The examiner asserts the following:

It would have been obvious to one having ordinary skill in the art at the time the invention was made to [sic] said circuitry having ... an aspect ratio greater than about 0.5. ..., since it has been held that where the general conditions of the claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

As discussed above, Boggs does not teach a specific circuit or method of producing circuitry and, therefore, inherently teaches a conventional prior art circuitry. The specification of the present application clearly establishes that conventional circuitry does not have an aspect ratio greater than about 0.5. Specifically, as provided at page 2 line 22 through page 3 line 4:

The subtractive etch method of circuitization, described above, yields a subcomposite having limited wiring density. When conductive metal is etched to form spaces between lines of circuitry, the conductive metal which is covered by photoresist during formation of circuitry, is susceptible to erosion by the etchant in areas beneath the photoresist. To avoid this problem, the thickness of the circuit lines divided by the width of the spaces between them, i.e. the aspect ratio, must be sufficiently low to produce a functional product. The width of spaces limits wiring density. For example, a typical circuit board

that has circuit lines about 1 mil thick, requires line and space widths of at least about 3 mils.

In contrast, an aspect ratio greater than about 0.5 is claimed by claim 10 and supported in the specification at page 10 lines 14 through 23:

Next, fine-line circuitry is created preferably by electroless deposition. FIG. 10 shows the portions of subcomposite 16 created by the pattern of photoresist 30 is plated with a layer of conductive metal 40 thereby resulting in printed circuit board 42. Conductive metal 40, preferably copper, is plated to 0.1 mil or greater, preferably about 0.1 mil to about 4 mils, and most preferably about 0.2 mil to about 2.0 mils thick. Printed circuit board 42 has an aspect ratio preferably greater than about 0.5 and more preferably greater than about 1.


Therefore, under the law, as it is stated In re Aller, and in particular In re O'Farrell, it is clear that since Boggs gives no indication that his circuitry has an aspect ratio preferably greater than about 0.5 as claimed by claim 10, and no direction as to how to produce said aspect ratio under conventional means known to one skilled in the art, and no other prior art has been cited by the examiner to modify Boggs to teach the invention as claimed in claim 10, claim 10 is believed to be allowable over Boggs.

Claims 13, 16 and 19 are dependent upon and include all of the limitations of claim 10 and are, therefore, for the above reasons not properly rejected under 35 USC § 103 over Boggs, and are similarly believed to be allowable as submitted.

Applicants are providing clean and marked-up versions of pages 6 and 11 of the specification and of the Abstract. As indicated earlier, three sheets of revised drawings are also being submitted.

Respectfully submitted,

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Enclosures

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